CLAIMS

We claim:

1. An apparatus for introducing particles into a microdevice conduit, comprising:

a microdevice comprised of a substrate having a microchannel formed therein and a cover plate arranged over the substrate such that the cover plate in combination with the microchannel at least partially defines the conduit, wherein the conduit extends from an inlet to an outlet, and the inlet terminates at an opening located on an exterior surface of the microdevice;

a dispenser containing fluid that optionally contains a slurry and having a dispensing orifice, wherein the slurry, when present is comprised of a plurality of particles in a carrier fluid and the dispensing orifice is sized to allow flow of the fluid therethrough without clogging;

a means for positioning the dispensing orifice and the inlet in fluid-tight alignment with each other without extending the dispenser past the opening of the inlet; and

a means for applying pressure to the fluid in the dispenser so as to transport the fluid into the conduit via the dispensing orifice and the inlet.

2. The apparatus of claim 1, wherein the microdevice is comprised of a plurality of substrates and/or cover plates.

3. The apparatus of claim 1, wherein the inlet extends through either the cover plate or the substrate.

4. The apparatus of claim 1, wherein the exterior microdevice surface on which the inlet opening is located is substantially planar.

5. The apparatus of claim 1, wherein the particles are chromatographic separation beads.

6. The apparatus of claim 1, wherein the positioning means is comprised of a means for moving the dispenser.

7. The apparatus of claim 6, wherein the moving means moves the dispenser along a vertical axis.

8. The apparatus of claim 6, wherein the moving means moves the dispenser along a single axis.

9. The apparatus of claim 6, wherein the moving means provides rotates the dispenser about a single axis.

10. The apparatus of claim 6, wherein the positioning means is further comprised of a means for immobilizing the microdevice.

11. The apparatus of claim 1, wherein the positioning means is comprised of a means for moving the microdevice.

12. The apparatus of claim 1, further comprising a seating member through which fluid communication is provided between the dispensing orifice and the inlet, when the dispensing orifice and the inlet are positioned in fluid-tight alignment.

13. The apparatus of claim 12, wherein the seating member is comprised of a polymeric material.

14. The apparatus of claim 12, wherein the seating member is comprised of a ceramic, a metal, a glass, or a combination thereof.

15. The method of claim 1, wherein the fluid contains the slurry.

16. The apparatus of claim 15, wherein the pressure-applying means is constructed to apply a pressure greater than about 1 bar to the slurry within the dispenser.

17. The apparatus of claim 16, wherein the pressure-applying means is constructed to apply a pressure greater than about 10 bars to the slurry within the dispenser.

18. The apparatus of claim 1, further comprising a means for filling the dispenser with fluid or slurry.

19. The apparatus of claim 18, wherein the filling means is constructed to fill the dispenser through the dispensing orifice.

20. The apparatus of claim 18, wherein the filling means is constructed to fill the dispenser from a plurality of different fluid or slurry sources.

21. The apparatus of claim 18, further comprising a means for providing relative motion between the means for filling the dispenser and the dispenser.

22. The apparatus of claim 21, wherein the relative motion providing means moves the filling means.

23. The apparatus of claim 21, wherein the relative-motion providing means moves the dispenser.

24. The apparatus of claim 1, comprising a plurality of dispensers each having a dispensing orifice.

25. The apparatus of claim 24, wherein each dispenser contains a different fluid or slurry.

26. The apparatus of claim 24, wherein the positioning means is constructed to position the dispensing orifices successively in fluid-tight alignment with the inlet.

27. A method for introducing particles into a microdevice conduit, comprising:

(a) positioning

(i) a dispensing orifice of a dispenser and

(ii) an inlet of a microdevice that terminates at an opening located on an exterior surface of the microdevice in fluid-tight alignment with each other without extending the dispenser past the opening of the inlet, wherein the microdevice is comprised of a substrate having a microchannel formed therein and a cover plate arranged over the substrate such that the cover plate in combination with the microchannel at least partially defines the conduit, and the conduit extends from the inlet to an outlet, wherein the dispenser contains a fluid that optionally contains a slurry comprised of a plurality of particles in a carrier fluid, and

the dispensing orifice is sized to allow flow of fluid therethrough without clogging; and

(b) applying pressure to the fluid in the dispenser so as to transport the fluid into the conduit via fluid flow through the dispensing orifice and the inlet.

28. The method of claim 27, wherein the fluid contains the slurry.

29. The method of claim 28, further comprising, before step (a), (a') agitating the slurry.

30. The method of claim 27, further comprising, before step (b), (b') transporting a different fluid or slurry through the inlet.

31. The method of claim 30, wherein each slurry contains particles of a different functionality.

32. The method of claim 31, wherein each slurry contains particles associated with different enzymes.

33. The method of claim 30, wherein each slurry contains particles of a different porosity.

34. The method of claim 30, wherein each slurry contains particles of a different size.

35. The method of claim 27, further comprising, after step (b), (c) removing any residue of the slurry from the dispenser.

36. The method of claim 35, further comprising, after step (c), (d) repeating steps (a) and (b) to transport an additional fluid or slurry into the conduit through the dispensing orifice and the inlet.

37. The method of claim 36, wherein each slurry contains particles of a different functionality.

38. The method of claim 37, wherein each slurry contains particles associated with different enzymes.

38. The method of claim 36, wherein each slurry contains particles of a different porosity.

40. The method of claim 36, wherein each slurry contains particles of a different size.

41. The method of claim 27, wherein steps (a) and (b) are repeated for a different microdevice.

42. The method of claim 27, wherein the particles occupy at least about 25 volume percent of the conduit.

43. The method of claim 27, wherein a particle bridge is formed in a bridging zone within the conduit.

44. A microdevice comprising:

a substrate having a microchannel formed therein;

a cover plate arranged over the substrate such that the cover plate in combination with the microchannel at least partially defines a conduit within the microdevice, wherein the conduit extends from an inlet to an outlet; and

a plurality of particles each individually sized to travel through the inlet and the conduit, wherein the particles occupy at least about 25 volume percent of the conduit.

45. A microdevice comprising:

a substrate having a microchannel formed therein;

a cover plate arranged over the substrate such that the cover plate in combination with the microchannel at least partially defines a conduit within the microdevice, wherein the conduit extends from an inlet through a bridging zone toward an outlet; and

a particle bridge located in the bridging zone, the bridge comprising a plurality of particles each individually sized to travel through the inlet, bridging zone, and the outlet.